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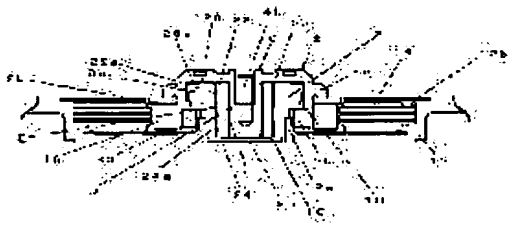
(54) SPINDLE MOTOR AND DISC DRIVER EMPLOYING THE SAME

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a spindle motor which can eliminate the negative pressure and the overlevitation of a rotor and can reduce a cost, and to provide a disc driver employing the spindle motor.
SOLUTION: A radial dynamic pressure bearing has a herringbone groove composed of an inner circumferential surface of a sleeve and an outer circumferential surface of an outer cylinder attached to a shaft. A thrust bearing has a dynamic pressure generating groove which is composed of the upper end surface of the sleeve and the bottom surface of a ceiling plate and applies pressure radially inward to oil when a rotor rotates. A bearing, having pressure practically balancing with the dynamic pressure generated by the radial bearing and/or the thrust bearing, is provided between an inner surface of a closing member and the end surface of the shaft. An oil linking hole through which the oil can be circulated is formed between the outer circumferential surface of the shaft and the inner circumferential surface of the outer cylinder.



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CLAIMS

[Claim(s)]
[Claim 1] A shaft and the sleeve in which the through tube in which this shaft is inserted loosely free [rotation] was formed, Rota which has the cylinder wall which hangs from the periphery edge of the circular top plate with which this shaft was prepared in the revolving-shaft alignment at one, and this top plate, It is the spindle motor which comes to have the lock out member which blockades one edge of the through tube formed in this sleeve. To the peripheral face of said shaft It is equipped with a cylinder-like outer case member. The upper limit side of said sleeve, and the base of the top plate of said Rota, In the peripheral face list of the inner skin of said sleeve, and said outer case member, between the end faces of the inside of said lock out member, said shaft, and said outer case member A continuous minute gap is formed. In said minute gap It is held continuously, without oil breaking off over the whole. The inner skin of said sleeve and the peripheral face of said outer case member at least in one of fields Radial dynamic pressure bearing in which the herringbone groove it comes [herringbone] to connect the spiral groove of a pair was prepared as a dynamic pressure generating slot is constituted. The upper limit side of said sleeve and the base of a top plate at least to either The thrust bearing section in which the dynamic pressure generating slot which gives the pressure which goes to the method of the inside of radial to said oil at the time of rotation of said Rota was established is constituted. Again between the inside of said lock out member, and the end face of said shaft Bearing which has the pressure balanced on the dynamic pressure generated in said radial bearing section and/or said thrust bearing section and parenchyma is formed. Said Rota It rises to surface by collaboration with said thrust bearing section and this bearing. Between the peripheral face of said shaft, and the inner skin of said outer case member Between the end faces of the minute gap formed between the upper limit side of said sleeve, and the base of the top plate of said Rota, the inside of said lock out member, said shaft, and said outer case member The spindle motor characterized by forming the free passage hole which opens said oil held in the minute gap formed for free passage possible [circulation].
[Claim 2] The spindle motor according to claim 1 characterized by what said free passage hole is prescribed for to the peripheral face of said shaft by by forming a streak of spiral slot ranging from the upper limit section to the lower limit section, and equipping the peripheral face of said shaft with said outer case member between this spiral slot and the inner skin of said outer case member.
[Claim 3] Said herringbone groove formed in the radial bearing section of this pair while estranging said radial bearing section in the direction of an axis and carrying out pair formation is a spindle motor according to claim 1 or 2 characterized by what the spiral groove of an equivalent configuration is connected substantially and formed so that induction of the fluid dynamic pressure of a pressure gradient which becomes symmetrical with the direction of an axis at the time of rotation of said Rota, respectively may be carried out to said oil.
[Claim 4] While estranging said radial bearing section in the direction of an axis and carrying out pair formation Said herringbone groove formed in the radial bearing section located in the side which approaches said thrust-bearing section among the radial bearing sections of this pair Connect the spiral groove of an unsymmetrical configuration and it is formed in the direction of an axis so that the pressure which goes to the bearing side formed between the inside of said lock out member and the end face of a shaft to said oil at the time of rotation of said Rota may be given. Moreover, said herringbone groove formed in the radial bearing section located in the side estranged from said thrust-bearing section The spindle motor according to claim 1 or 2 characterized by what the spiral groove of an equivalent configuration is connected substantially and formed so that the fluid dynamic pressure of a pressure gradient which becomes symmetrical with the direction of an axis to said oil at the time of rotation of said Rota may be given.
[Claim 5] While estranging said radial bearing section in the direction of an axis and carrying out pair formation, said herringbone groove formed in the radial bearing section of this pair Connect the spiral groove of an unsymmetrical configuration and are formed in the direction of an axis so that the pressure which goes to the bearing side formed between the inside of said lock out member and the end face of a shaft to said oil at the

time of rotation of said Rota, respectively may be given. The spindle motor according to claim 1 or 2 characterized by things.

[Claim 6] While estranging said radial bearing section in the direction of an axis and carrying out pair formation Said herringbone groove formed in the radial bearing section located in the side which approaches said thrust-bearing section among the radial bearing sections of this pair Connect the spiral groove of an unsymmetrical configuration and it is formed in the direction of an axis so that the pressure which goes to the bearing side formed between the inside of said lock out member and the end face of a shaft to said oil at the time of rotation of said Rota may be given. Moreover, said herringbone groove formed in the radial bearing section located in the side estranged from said thrust-bearing section The spindle motor according to claim 1 or 2 characterized by what the spiral groove of an unsymmetrical configuration is connected and is formed in the direction of an axis so that the pressure which goes to said thrust bearing section side to said oil at the time of rotation of said Rota may be given.

[Claim 7] While estranging said radial bearing section in the direction of an axis and carrying out pair formation Said herringbone groove formed in the radial bearing section located in the side which approaches said thrust-bearing section among the radial bearing sections of this pair Connect the spiral groove of an equivalent configuration substantially and it is formed so that the fluid dynamic pressure of a pressure gradient which becomes symmetrical with the direction of an axis to said oil at the time of rotation of said Rota may be given. Moreover, said herringbone groove formed in the radial bearing section located in the side estranged from said thrust-bearing section Connect the spiral groove of an unsymmetrical configuration and are formed in the direction of an axis so that the pressure which goes to the bearing side formed between the inside of said lock out member and the end face of a shaft to said oil at the time of rotation of said Rota may be given. The spindle motor according to claim 1 or 2 characterized by things.

[Claim 8] The peripheral face of said sleeve and the inner skin of the cylinder wall of said Rota are a spindle motor according to claim 1 to 7 which has countered radial through a clearance, and a taper side is established so that an outer diameter may reduce the diameter as it separates from the top plate of said Rota to the peripheral face of said sleeve, and is characterized by what said oil forms a meniscus and is held for between this taper side and the inner skin of said cylinder wall.

[Claim 9] The step a peripheral face carries out [the step] a cavity to the method of the inside of radial succeeding said taper side is prepared in said sleeve. To the inner skin of the cylinder wall of said Rota By the annular member which projects in the method of the inside of radial corresponding to this step fixing, and this step and this annular member being engaged The omission stop of said Rota is constituted. Between the top face of this annular member, and the inferior surface of tongue of the step of said sleeve The spindle motor according to claim 8 characterized by what the **** minute gap is formed rather than the minimum clearance dimension of the radial gap formed between the taper side of said sleeve, and the inner skin of the cylinder wall of said Rota, and is functioned as a labyrinth seal.

[Claim 10] Said Rota is a spindle motor according to claim 1 to 9 characterized by what is energized by the magnetic force which acts in the direction of an axis toward said lock out member side.

[Claim 11] It is the disk driving gear which is a disk driving gear which has the spindle motor which is fixed to the interior of housing and this housing, and is made to rotate this record medium in the disk driving gear with which it is equipped with the disc-like record medium which can record information, and an information access means for writing in or reading information to the necessary location of this record medium, and is characterized by what said spindle motor is a spindle motor indicated to claim 1 thru/or either of 10.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the spindle motor equipped with the hydrodynamic bearing, and the disk driving gear using this spindle motor.
[0002]
[Description of the Prior Art] In order to support a shaft and a sleeve as bearing of the spindle motor used from the former in the disk driving gear which drives record disks, such as a hard disk, enabling free relative rotation, the hydrodynamic bearing using the fluid pressure of lubrication fluids, such as oil made to intervene among both, is proposed variously.
[0003] An example of the spindle motor which uses such a hydrodynamic bearing is shown in drawing 1 . The spindle motor which uses this conventional fluid hydrodynamic bearing Between the peripheral face of the shaft b which makes Rota a and one, and the inner skin of the sleeve c in which this shaft b is inserted free [rotation] The radial bearing sections d and d of a pair estrange in the direction of an axis, and are constituted. Moreover, between the thrust bushes f which blockade the inferior surface of tongue of a thrust plate e, and one opening of Sleeve b in the list between the top face of the disk-like thrust plate e which projects in the method of the outside of radial from one edge outside peripheral surface of Shaft a, and the flat sides of the step formed in Sleeve b The thrust bearing sections g and g of a pair are constituted.
[0004] In a shaft b list at a thrust plate e and a sleeve c list between thrust bushes d A series of minute gaps are formed. All over these minute gaps It is held continuously, without oil breaking off as a lubrication fluid (such oil maintenance structure). g1 and g1 are formed in the herringbone groove d1 for carrying out induction of the dynamic pressure to the radial bearing sections d and d and the thrust bearing sections g and g which are described as "full philharmonic structure" below into oil at the time of rotation of Rota a, and d1 list, respectively.
[0005] Moreover, the herringbone grooves d1 and d1 which come to connect the spiral groove of a pair, and g1 and g1 are formed in the radial bearing sections d and d and the thrust-bearing sections g and g, the maximum dynamic pressure is generated in the center section of bearing in which the connection section of a spiral groove is located according to rotation of Rota a, and the load which acts on Rota a is supported.
[0006]
[Problem(s) to be Solved by the Invention] In the thrust-bearing sections g and g, in near the upper limit section of the sleeve c located in the opposite side in the direction of an axis, the taper seal section h is formed, the surface tension and the atmospheric pressure of oil balance, and the interface consists of such spindle motors. That is, the internal pressure of the oil within this taper seal section h is maintained by the equivalent pressure on atmospheric pressure and parenchyma.
[0007] Now, if Rota a begins rotation, oil is the dynamic pressure generating slots d1 and d1 and a pumping by g1 and g1, and while it is drawn in the core side of each radial bearing sections d and d and the thrust bearing sections g and g and fluid dynamic pressure serves as the maximum in the core of bearing, the internal pressure of oil will fall by the edge side of bearing. On the other hand, although it is possible for an interface to move in the inside of the taper seal section h according to fluctuation of oil internal pressure, and to rival atmospheric pressure and the internal pressure of oil at the edge of the side which adjoins the taper seal section h among the radial bearing sections The inside of the field between each bearing (i.e., between the peripheral face of Shaft b, and the inner skin of Sleeve c), The inside of the field around the oil held among the radial bearing sections d and d of a pair, and a thrust plate e, The internal pressure of oil falls according to the dynamic pressure generating slots d1 and d1 and the pumping of g1 and g1, and the oil held near the periphery section of the thrust plate located among the thrust bearing sections g and g falls below to atmospheric pressure soon, and serves as negative pressure.
[0008] Moreover, in the case of the hydrodynamic bearing of full philharmonic structure, the configuration of

the dynamic pressure generating slot formed in bearing may not be asked, but negative pressure may arise in oil.
[0009] It becomes uneven [processing of the inner skin of a sleeve or the peripheral face of a shaft] the direction upper limit section of an axis and the lower limit section [this]. By the radial-clearance dimension of the minute gap formed between the inner skin of a sleeve and the peripheral face of a shaft being larger than a lower limit section side, and being formed, the direction upper limit section side of an axis The pumping force from the direction lower limit section side of an axis exceeds [the fluid dynamic pressure generated by the herringbone groove formed in radial dynamic pressure bearing] the pumping force from an upper limit section side. A pressure gradient serves as imbalance at the direction upper limit section side of an axis, and when a flow by which it goes to oil at the direction upper limit section side of an axis carries out induction, it generates.
[0010] When the radial-clearance dimension of the minute gap formed between the inner skin of a sleeve and the peripheral face of a shaft is larger than an upper limit section side and the direction lower limit section side of an axis is formed contrary to this, Induction of the flow of the oil which goes to the direction lower limit section side of an axis is carried out to oil, the internal pressure of the oil held between the inferior surface of tongue of a thrust plate and a thrust bush increases beyond the need, and fault surfacing to which Rota surfaces more than the specified quantity occurs.
[0011] If negative pressure arises in oil, for example at the time of a filling-with-oil activity etc., the air which melted in oil will air-bubbles-ize, and it will appear. The problem which influences the endurance and dependability of a spindle motor of air bubbles carrying out cubical expansion and making oil leak to the bearing exterior by a temperature rise etc. soon, Or the problem on which a dynamic pressure generating slot influences the rotation precision of a spindle motor called generating of vibration and the aggravation of NRRO (non-repeatability deflection component) by contacting air bubbles occurs.
[0012] Moreover, if fault surfacing occurs in Rota, wear by contact to a thrust plate and a sleeve will occur, and it will become the cause which spoils dependability in the endurance list of bearing. In addition, since contiguity arrangement of the recording surface and the magnetic head of a hard disk is extremely carried out with high-capacity-izing of a hard disk in the case of the spindle motor for a hard disk drive, there is concern which destruction by contact to a hard disk and the magnetic head generates.
[0013] In addition, the problem of the above-mentioned fault surfacing may be generated also besides processing of the inner skin of a sleeve or the peripheral face of a shaft becoming uneven.
[0014] Like the conventional spindle motor shown in drawing 1 , in order to hold record disks, such as a hard disk, fixed to the peripheral face of Rota a in the case of a thin spindle motor, it may be formed to the depth to which the female screw hole i prepared since a clamper was fixed to the upper limit section of Shaft b results in the inner circumference side of the radial bearing sections d and d. In such a case, if a male screw (un-illustrating) is concluded in the female screw hole i, the peripheral face of Shaft b bulges in the method of the outside of radial with the conclusion stress. The radial-clearance dimension of the minute gap formed between the inner skin of Sleeve c and the peripheral face of Shaft b The direction upper limit section side of an axis becomes narrower than a lower limit section side, and becomes imbalanced [the pressure gradient of the fluid dynamic pressure generated in the radial dynamic pressure bearings d and d] to the direction lower limit section side of an axis, and fault surfacing of Rota a occurs.
[0015] Maintaining simple structure and desired bearing rigidity, it prevents generating of negative pressure or fault surfacing of Rota, and this invention aims at offering the spindle motor in which low-cost-izing is possible, and the disk driving gear using this spindle motor.
[0016]
[Means for Solving the Problem] The sleeve in which the through tube inserted by the spindle motor of this invention free [rotation of a shaft and this shaft] was formed, Rota which has the cylinder wall which hangs from the periphery edge of the circular top plate with which this shaft was prepared in the revolving-shaft alignment at one, and this top plate, It is the spindle motor which comes to have the lock out member which blockades one edge of the through tube formed in this sleeve. To the peripheral face of said shaft It is equipped with a cylinder-like outer case member. The upper limit side of said sleeve, and the base of the top plate of said Rota, In the peripheral face list of the inner skin of said sleeve, and said outer case member, between the end faces of the inside of said lock out member, said shaft, and said outer case member A continuous minute gap is formed. In said minute gap It is held continuously, without oil breaking off over the whole. The inner skin of said sleeve and the peripheral face of said outer case member at least in one of fields Radial dynamic pressure bearing in which the herringbone groove it comes [herringbone] to connect the spiral groove of a pair was prepared as a dynamic pressure generating slot is constituted. The upper limit side of said sleeve and the base of a top plate at least to either The thrust bearing section in which the dynamic pressure

generating slot which gives the pressure which goes to the method of the inside of radial to said oil at the time of rotation of said Rota was established is constituted. moreover, between the inside of said lock out member, and the end face of said shaft Bearing which has the pressure balanced on the dynamic pressure generated in said radial bearing section and/or said thrust bearing section and parenchyma is formed. Said Rota It rises to surface by collaboration with said thrust bearing section and this bearing. Between the peripheral face of said shaft, and the inner skin of said outer case member Between the end faces of the minute gap formed between the upper limit side of said sleeve, and the base of the top plate of said Rota, the inside of said lock out member, said shaft, and said outer case member It is characterized by forming the free passage hole which opens said oil held in the minute gap formed for free passage possible [circulation] (claim 1).

[0017] This configuration makes it possible to prevent generating of fault surfacing by balance of the pressure of the oil held at bearing circles in a scale and a negative pressure list in the spindle motor which used the hydrodynamic bearing of full philharmonic structure.

[0018] In the above-mentioned structure, non-contact support of Rota will be carried out to a sleeve and a lock out member by bearing (such bearing is described as "static pressure bearing" below) like the so-called hydrostatic bearing to which the pressure up of the pressure of oil is carried out because the dynamic pressure generated in the radial bearing section and the thrust-bearing section which give dynamic pressure to oil at the time of rotation, and these radial bearing section and the thrust-bearing section spreads.

[0019] The free passage way which makes the oil held at the thrust bearing section located in the direction of axis vertical edge of the minute gap formed between the inner skin of a sleeve, and the peripheral face of an outer case member at this time, and the above-mentioned static pressure bearing open for free passage possible [circulation] by forming between the peripheral face of a shaft, and the inner skin of an outer case member Since a flow of oil is attained from a high-pressure field through a free passage way at a low-pressure field side even if imbalance arises to the pressure of the oil held in bearing according to the stress deformation resulting from the processing tolerance and assembly of a bearing configuration member etc., the problem resulting from fault surfacing of the negative pressure in oil or Rota is solved.

[0020] Moreover, a streak of spiral slot is formed in the peripheral face of said shaft ranging from the upper limit section to the lower limit section, and the spindle motor of this invention is characterized by what said free passage hole is specified for between this spiral slot and the inner skin of said outer case member by equipping the peripheral face of said shaft with said outer case member (claim 2).

[0021] By forming in the peripheral face of a shaft the spiral slot which constitutes a free passage hole between the inner skin of an outer case member, chucking can perform processing of a shaft peripheral face, and formation of a spiral slot once, and it becomes possible to process it easily. As for the cross-section configuration of this spiral slot, it is desirable to consider as the shape of the shape of an abbreviation rectangle, the shape of a triangle, and a semicircle.

[0022] In the spindle motor of above-mentioned this invention, while estranging said radial bearing section in the direction of an axis and carrying out pair formation, said herringbone groove formed in the radial bearing section of this pair is characterized by what the spiral groove of an equivalent configuration is connected substantially and formed so that induction of the fluid dynamic pressure of a pressure gradient which becomes symmetrical with the direction of an axis at the time of rotation of said Rota, respectively may be carried out to said oil (claim 3).

[0023] By estranging the radial bearing section in the direction of an axis, carrying out pair formation, and using each dynamic pressure generating slot as the herringbone groove of a configuration symmetrical with the direction of an axis Distance between the articulated sections of the spiral groove which serves as the maximum dynamic pressure in each radial bearing section in the limited direction dimension of an axis (hereafter the distance between the articulated sections of the spiral groove in this radial bearing section) a "bearing span" -- indicating -- the maximum -- since it becomes possible to secure greatly, and it becomes possible to maintain bearing rigidity highly even if it is a thin motor, generating of the circumference of deflections, such as a precession of Rota at the time of rotation, is controlled effectively.

[0024] As a configuration of the dynamic pressure generating slot of the radial bearing section in the spindle motor of this invention Said herringbone groove formed in the radial bearing section located in the side which approaches said thrust-bearing section among the radial bearing sections of a pair besides the above The spiral groove of an unsymmetrical configuration is connected and formed in the direction of an axis so that the pressure which goes to the bearing side formed between the inside of said lock out member and the end face of a shaft to said oil at the time of rotation of said Rota may be given. Moreover, said herringbone groove formed in the radial bearing section located in the side estranged from said thrust-bearing section Connect and form the spiral groove of an equivalent configuration substantially so that the fluid dynamic pressure of a pressure gradient which becomes symmetrical with the direction of an axis to said oil at the time of rotation of

said Rota may be given (claim 4). Or said herringbone groove formed in the radial bearing section of a pair The spiral groove of an unsymmetrical configuration is connected and formed in the direction of an axis so that the pressure which goes to the bearing side formed between the inside of said lock out member and the end face of a shaft to said oil at the time of rotation of said Rota, respectively may be given (claim 5). Said herringbone groove formed in the radial bearing section located in the side which approaches said thrust-bearing section among the radial bearing sections of a pair The spiral groove of an unsymmetrical configuration is connected and formed in the direction of an axis so that the pressure which goes to the bearing side formed between the inside of said lock out member and the end face of a shaft to said oil at the time of rotation of said Rota may be given. Moreover, said herringbone groove formed in the radial bearing section located in the side estranged from said thrust-bearing section Connect and form the spiral groove of an unsymmetrical configuration in the direction of an axis so that the pressure which goes to said thrust bearing section side to said oil at the time of rotation of said Rota may be given (claim 6). Or said herringbone groove formed in the radial bearing section located in the side which approaches said thrust-bearing section among the radial bearing sections of a pair The spiral groove of an equivalent configuration is substantially connected and formed so that the fluid dynamic pressure of a pressure gradient which becomes symmetrical with the direction of an axis to said oil at the time of rotation of said Rota may be given. Moreover, said herringbone groove formed in the radial bearing section located in the side estranged from said thrust-bearing section It is possible to connect and form the spiral groove of an unsymmetrical configuration in the direction of an axis so that the pressure which goes to the bearing side formed between the inside of said lock out member and the end face of a shaft to said oil at the time of rotation of said Rota may be given etc. (claim 7).

[0025] The difference in the operation effectiveness by the difference in the configuration of the herringbone groove of these radial bearing section is indicated in a detail in explanation of the gestalt of implementation of invention.

[0026] Furthermore, a taper side is established so that an outer diameter may reduce the diameter of it as the peripheral face of said sleeve and the inner skin of the cylinder wall of said Rota have countered radial through a clearance and the spindle motor of this invention separates from the top plate of said Rota to the peripheral face of said sleeve, and it is characterized by what said oil forms a meniscus and is held for between this taper side and the inner skin of said cylinder wall (claim 8).

[0027] since oil is held by the hydrodynamic bearing of full philharmonic structure at the whole bearing compared with the conventional structure where the edge of the oil held at each bearing was exposed in the open air, the amount of oil maintenance is markedly alike, and is increasing. Therefore, when oil carries out thermal expansion by the temperature rise, by bearing, the oil it became impossible to be unable to hold will flow into seal circles in large quantities. Therefore, in the hydrodynamic bearing of full philharmonic structure, the configuration of the seal section also serves as an important matter.

[0028] With constituting the taper seal section which formed the taper-like gap between the peripheral face of a sleeve, and the inner skin of the cylinder wall of Rota, and used surface tension like the above-mentioned configuration While being able to make the seal section into a major diameter rather than bearing, even if it can consider as size in [the direction dimension of an axis of the seal section] comparison, the volume of seal circles increases and it is small and a thin spindle motor Imitation becomes possible enough to the thermal expansion of the oil held so much at the hydrodynamic bearing of full philharmonic structure.

[0029] The spindle motor of this invention in addition, to said sleeve The step a peripheral face carries out [the step] a cavity to the method of the inside of radial succeeding said taper side is prepared. To the inner skin of the cylinder wall of said Rota By the annular member which projects in the method of the inside of radial corresponding to this step fixing, and this step and this annular member being engaged The omission stop of said Rota is constituted. Between the top face of this annular member, and the inferior surface of tongue of the step of said sleeve It is characterized by what the **** minute gap is formed rather than the minimum clearance dimension of the radial gap formed between the taper side of said sleeve, and the inner skin of the cylinder wall of said Rota, and is functioned as a labyrinth seal (claim 9).

[0030] In this configuration, the outflow of the oil to the bearing exterior by the oil mist is more effectively prevented by arranging a labyrinth seal succeeding the taper seal section by forming the configuration of Rota which falls out and serves as a stop in the location which is the bearing exterior and aligns radial dynamic pressure bearing and radial, while thin shape-ization of a spindle motor is promoted further.

[0031] Furthermore, the spindle motor of this invention is characterized by what said Rota is energized for by the magnetic force which acts in the direction of an axis toward said lock out member side again (claim 10).

[0032] The posture at the time of rotation of Rota is further stabilized by energizing magnetically in the direction which counters in the surfacing force of generating Rota by the thrust bearing section and static pressure bearing a lock out edge side that is, and the direction of an axis.

[0033] Moreover, the disk driving gear of this invention is the disk driving gear which has the spindle motor which is fixed to the interior of housing and this housing, and is made to rotate this record medium in the disk driving gear with which it is equipped with the disc-like record medium which can record information, and an information access means for writing in or reading information to the necessary location of this record medium, and said spindle motor is characterized by what is been the spindle motor indicated to claim 1 thru/or either of 10 (claim 11).
[0034] Although the spindle motor of this invention is suitably usable in the disk driving gear which drives the hard disk whose outer diameter is 1 inch from small and thin-shape-izing being possible, for example, it is not limited to this but becomes usable similarly in the disk driving gear which drives an attachment-and-detachment-type record medium, such as fixed [, such as a hard disk,] or CD-ROM, and DVD.
[0035]
[Embodiment of the Invention] Although the operation gestalt of the spindle motor concerning this invention and the disk driving gear using this spindle motor is hereafter explained with reference to drawing 2 thru/or drawing 8 , this invention is not limited to the example shown below.
[0036] In the block diagram 2 of a spindle motor (1) This spindle motor The rotor hub 2 which consists of approximate circle tabular upper wall section 2a (top plate) and cylindrical peripheral wall section 2b (cylinder wall) which hangs caudad from the periphery edge of this upper wall section 2a, Rota 6 which consists of shafts 4 formed in the center section of upper wall section 2a of this rotor hub 2 at one, The outer case member 5 of the shape of a cylinder with which the peripheral face of this shaft 4 is equipped, and the bell shape sleeve 8 supported for the outer case member 5 in these shaft 4 list, enabling free rotation, The lower part of this sleeve 8 is blockaded and the free edge side edge side of a shaft 4, the seal cap 10 (lock out member) which counters, and the bracket 12 with which body 12a by which a sleeve 8 is inner-**(ed) was formed in one are provided.
[0037] The Rota magnet 16 fixes so that it may have the configuration of the shape of **** centering on body 12a to the bracket 12, and the stator 14 which has two or more teeth which protrude on the method of the inside of radial in inner skin 12b of the peripheral wall which makes the shape of this bowl may be arranged and the peripheral face of peripheral wall section 2b of a rotor hub 2 may be countered through a gap from this stator 14 and the method of the inside of radial.
[0038] Flange-like disk installation section 2c to lay the disk plate (for it to illustrate as a disk plate 53 in drawing 8) with which information is recorded is formed in the periphery section of peripheral wall section 2b of a rotor hub 2. Female screw hole 4b is formed in the upper part side (upper wall section 2a side of a rotor hub 2) of a shaft 4, a disk plate is laid on disk installation section 2c, and after holding by the clamper which is not illustrated, a disk plate is held fixed in a rotor hub 2 by concluding a male screw (un-illustrating) in female screw hole 4b.
[0039] In the outer case member 5 list which follows between the peripheral faces of the outer case member 5 and the inner skin of a sleeve 8 which follow upper wall section 2a of a rotor hub 2 between the upper limit side of a sleeve 8, and the inferior surface of tongue of upper wall section 2a of a rotor hub 2, and this, between the end face of a shaft 4, and the inside of a seal cap 10 A series of minute gaps are formed, and it is held continuously, without oil breaking off all over this minute gap, and the so-called hydrodynamic bearing of full philharmonic structure is constituted. In addition, an axial manner of support is behind explained in full detail in the configuration list of the bearing in this operation gestalt.
[0040] Moreover, between the peripheral face of a shaft 4, and the inner skin of the outer case member 5, the free passage hole 7 which opens for free passage the oil held between the upper limit side of a sleeve 8 and the inferior surface of tongue of upper wall section 2a of a rotor hub 2 and the oil held between the end face of a shaft 4 and the inside of a seal cap 10 in outer case member 5 list possible [circulation] is formed as explained in full detail behind.
[0041] Annular flange 8a formed in the shape of an inclined plane was prepared in the upper limit section of the peripheral face of a sleeve 8 so that the diameter might be reduced as it protrudes on the method of the outside of radial and a peripheral face estranges from the upper limit side of a sleeve 8, and it has countered radial in the state of the inner skin of peripheral wall section 2a of a rotor hub 2, and non-contact.
[0042] The radial gap dimension of the gap specified between the inner skin of this peripheral wall section 2b and the peripheral face of flange 8a is formed in the shape of an inclined plane as the peripheral face of flange 8a is the above, and it is increased gradually in the shape of a taper toward the direction lower part of an axis (the direction of a point of peripheral wall section 2b). That is, the inner skin of this peripheral wall section 2b and the peripheral face of flange 8a collaborate, and the taper seal section 18 is constituted. Between the upper limit side of a sleeve 8, and the inferior surfaces of tongue of upper wall section 2a of a rotor hub 2, The oil held in a series of minute gaps formed between the end faces of a shaft 4 and the insides of a seal cap 10

which follow between the peripheral faces of a shaft 4 and the inner skin of a sleeve 8 following upper wall section 2a of a rotor hub 2 and this Only in this taper seal section 18, the surface tension of oil and an outside atmospheric pressure balance, and the interface of oil and air is formed in the shape of a meniscus.
[0043] The taper seal section 18 has the movable formation location of an interface suitably according to the amount of oil which functions as an oil reservoir and is held in the taper seal section 18. Therefore, while the oil held in the taper seal section 18 is supplied to bearing with reduction of the amount of oil maintenance, the oil of the part to which the volume increased by thermal expansion etc. is held in this taper seal section 18.
[0044] Thus, a taper-like gap is formed between the peripheral face of flange 8a of a sleeve 8, and the inner skin of peripheral wall section 2b of a rotor hub 2, and with constituting the taper seal section 18 using surface tension, while the taper seal section 18 serves as a major diameter from bearing, it can consider as size in [the direction dimension of an axis of the taper seal section 18] comparison. Therefore, the volume in the taper seal section 18 increases, and imitation becomes possible enough also to the thermal expansion of the oil held so much at the hydrodynamic bearing of full philharmonic structure.
[0045] To the point, the annular ****** ring 20 (annular member) has fixed with means, such as adhesion, rather than the taper seal section 18 of peripheral wall section 2b. This ****** ring 20 is fitting in each other in the state of non-contact to the lower part of flange 8a in the lower limit section of the peripheral face of a sleeve 8, Rota 6 to a sleeve 8 falls out, and stop structure is constituted. Thus, alignment arrangement of the radial bearing section and ****** structure of a pair which are explained in full detail behind is not carried out on the same line in the direction of an axis with constituting the ****** structure of Rota 6 in the peripheral face side of a sleeve 8. Therefore, it becomes possible to utilize the overall length of a shaft 4 effectively as bearing, and thin shape-ization of the further motor is realized, maintaining bearing rigidity.
[0046] The top face of the ****** ring 20 has countered through the gap of the direction of an axis which follows the inferior surface of tongue and the taper seal section 18 of flange 8a, and has a **** clearance dimension rather than the minimum clearance dimension of the radial gap of the taper seal section 18.
[0047] By setting up as small as possible the gap dimension of the minute gap of the direction of an axis specified between the top face of the ****** ring 20, and the inferior surface of tongue of flange 8a A difference with the rate of flow of the air in the radial gap specified in the rate of flow and the taper seal section 18 of air in the minute gap of this direction of an axis at the time of rotation of a spindle motor becomes large. Effluent resistivity to the exterior of the steam produced when oil evaporated is enlarged, and vapor pressure [/ near the interface of oil] is kept high, and it functions as a labyrinth seal so that evapotranspiration of the further oil may be prevented.
[0048] Thus, the outflow of the oil as a liquid is not only prevented, but it becomes possible by allotting a labyrinth seal succeeding the taper seal section 18 to also prevent the outflow to the motor exterior of the oil mist generated because oil evaporates by the rise of the external-environment temperature of a motor etc. Therefore, the fall of the amount of oil maintenance can be prevented, the bearing engine performance stabilized over the long period of time can be maintained, and it can consider as bearing with high endurance and dependability.
[0049] (2) In addition to the configuration, next drawing 2 of bearing, explain the configuration of bearing in this operation gestalt with reference to drawing 3 and drawing 4 .
[0050] So that it may illustrate to drawing 3 to the inner skin of a sleeve 8 Carry out induction of the fluid dynamic pressure to the upper limit side side of a sleeve 8 in oil at the time of rotation of Rota 6. Herringbone groove 22a of the shape of the spiral groove 22a1 of the pair which inclines in the direction which conflicts to a hand of cut, and a character of abbreviation "**" constituted by connecting 22a2 is formed, and the up radial dynamic pressure bearing 22 is constituted between the peripheral faces of the outer case member 5.
[0051] Moreover, herringbone groove 24a of the shape of the spiral groove 24a1 of the pair which inclines in the direction which carries out induction of the fluid dynamic pressure to oil at the time of rotation of Rota 6, and which conflicts to a hand of cut, and a character of abbreviation "**" constituted by connecting 24a2 is formed in the free edge side of a shaft 4, and the lower radial dynamic pressure bearing 24 is constituted by the inner skin of a sleeve 8 between the peripheral faces of the outer case member 5.
[0052] In addition, the herringbone grooves 22a and 24a formed in the upper part and the lower radial dynamic pressure bearings 22 and 24 As the equivalent pumping force substantially generated in each spiral groove 22a1, 22a2, 24a1, and 24a2 It is set up so that a slot item called the tilt angle or the flute width, and the depth to a dimension and a hand of cut of the direction of an axis may become the same, i.e., it is set up so that each spiral groove 22a1, 22a2, 24a1, and 24a2 may become axial symmetry to the connection section. therefore, in the upper part and the lower radial dynamic pressure bearings 22 and 24 The maximum dynamic pressure appears in the direction center section of an axis of bearing (each spiral groove 22a1, 22a2, 24a1, and connection section of 24a2). The pumping by each spiral groove 22a1, 22a2, 24a1, and 24a2 becomes

imbalanced to the direction of one of the directions of an axis, and a flow of the direction of an axis does not occur in oil.
[0053] The herringbone grooves 22a and 24a of the upper part and the lower radial bearing sections 22 and 24 by thus, the thing to consider as a configuration symmetrical with the direction of an axis since it becomes possible to boil comparatively the upper part and the lower radial bearing section 22, and the bearing span between 24, and to set them up greatly even if it is in the direction dimension of an axis restricted by thin shape-ization It becomes possible to maintain bearing rigidity highly, and it can control effectively generating of the circumference of deflections, such as a precession of Rota 6.
[0054] Furthermore, spiral groove 26a of the pump in which carries out induction of the pressure which goes to the method of the inside of radial (shaft 4 side) to oil at the time of rotation of Rota 6 is formed in the upper limit side of a sleeve 8, and the thrust bearing section 26 is constituted between the inferior surfaces of tongue of upper wall section 2a of a rotor hub 2 as illustrated to drawing 4 .
[0055] Moreover, between the free edge side edge side of a shaft 4, and the inside of a seal cap 10, the static pressure bearing 28 using the internal pressure of the oil raised by spiral groove 26a of the thrust-bearing section 26 is constituted as explained in full detail behind.
[0056] (3) Explain the axial manner of support by each bearing constituted as the axial manner-of-support above in full detail with reference to drawing 5 . Drawing 5 In addition, between the upper limit side of a sleeve 8, and the inferior surfaces of tongue of upper wall section 2a of a rotor hub 2, The relative relation of the pressure distribution of the oil held all over the minute gap formed in the outer case member 5 list which follows between the peripheral faces of the outer case member 5 and the inner skin of a sleeve 8 following upper wall section 2a of a rotor hub 2, and this between the end face of a shaft 4, and the inside of a seal cap 10 Although it is the pressure distribution chart which developed for every bearing and was shown typically, since the pressure distribution of a spindle motor serve as axial symmetry, the pressure distribution of the field which serves as the opposite side in the longitudinal section of a spindle motor are omitted to the revolving-shaft alignment shown with an alternate long and short dash line in drawing 5 . Moreover, the number shown in drawing 5 is the same as the number attached to each bearing in drawing 2 .
[0057] In the upper part and the lower radial hydrodynamic bearings 22 and 24, with rotation of Rota 6, the pumping force by the herringbone grooves 22a and 24a increases, and fluid dynamic pressure arises. As shown in drawing 5 , the pressure distribution in the upper part and the lower radial dynamic pressure bearings 22 and 24 increase rapidly, and serve as the maximum from the both-ends side of the herringbone grooves 22a and 24a in the connection section of each spiral groove. Using the fluid dynamic pressure besides generated in the section and the lower radial dynamic pressure bearings 22 and 24, axial support is carried out from the direction of axis vertical section of the outer case member 5, and Rota 6 is bearing an alignment operation and the restoration operation which receives falling of Rota 6.
[0058] In the thrust-bearing section 26, induction of the pressure which goes to the method of the inside of radial by spiral groove 26a of pump in at oil is carried out with rotation of Rota 6. It is urged to a flow of oil, the internal pressure of oil is raised by the pressure which goes to the method of the inside of radial [this], and the fluid dynamic pressure which acts in the surfacing direction of Rota 6 occurs. In addition, the fluid dynamic pressure by which induction is carried out in the thrust-bearing section 26 is extent which does not increase rapidly like the upper part and the lower radial dynamic pressure bearings 22 and 24, and exceeds atmospheric pressure a little at the maximum, as shown in drawing 5 .
[0059] The oil currently held between the end face of a shaft 4 and the inside of a seal cap 10 in the outer case member 5 list which follows between the peripheral faces of the outer case member 5 and the inner skin of a sleeve 8 following upper wall section 2a of a rotor hub 2 and this with the pressure generated in the thrust-bearing section 26 The herringbone grooves 22a and 24a which will be in the condition of having been sealed on parenchyma in pressure, and are formed in the upper part and the lower radial dynamic pressure bearings 22 and 24 are made into a configuration symmetrical with the direction of an axis. By making dynamic pressure to generate into the condition of having balanced in the direction of an axis, induction of the flow of the direction of an axis is not carried out to oil as above-mentioned. The internal pressure of the oil held between the end face of a shaft 4 and the inside of a seal cap 10 by this in the outer case member 5 list which follows between the peripheral face of the outer case member 5 and the inner skin of a sleeve 8 and this balances with the internal pressure of the oil held at the thrust-bearing section. Therefore, the negative pressure which it becomes equivalent to the internal pressure of the oil held also in which field at the thrust bearing section 26, and internal pressure turns into below atmospheric pressure in the oil held all over these minute gaps does not occur as drawing 5 is shown. Therefore, the problem of the air bubbles resulting from negative pressure is solved.
[0060] As above-mentioned, the pressure generated in the thrust bearing section 26 is extent exceeding

atmospheric pressure a little, and is difficult to fully surface Rota 6 only now. However, the internal pressure of the oil held at the static pressure bearing 28 constituted by outer case member 5 list between the end face of a shaft 4, and the inside of a seal cap 10 as above-mentioned Since it becomes a pressure equivalent to the internal pressure of the oil raised by the fluid dynamic pressure by which induction is carried out in the thrust bearing section 26, collaboration with the thrust bearing section 26 and the static pressure bearing 28 enables it to fully surface Rota 6.

[0061] In addition, the annular thrust yoke 30 which becomes an opposite location with the Rota magnet 16 of a bracket 12 from ferromagnetic material is arranged so that it may be illustrated in drawing 2 . By generating the magnetic-attraction force of the direction of an axis between the Rota magnet 16 and a thrust yoke 30 It was made to balance with ****** of Rota 6 generated in the thrust-bearing section 26 and the static pressure bearing 28, support of the thrust direction of Rota 6 was stabilized, and generating of fault surfacing to which Rota 6 surfaces beyond the need is controlled. As for the magnetic energization to such Rota 6, it is possible to make it act also by making different the magnetic core of a stator 14 and the Rota magnet 16 in the direction of an axis.

[0062] (5) The configuration and operation drawing 6 of a free passage hole are the front view expanding and showing a shaft 4. One articles spiral slot 4a (a broken line shows a part) from the direction upper limit section of an axis to the lower limit section is prepared in the peripheral face of a shaft 4 so that it may illustrate to drawing 6 .

[0063] This spiral slot 4a is formed of cutting so that a cross-section configuration may turn into the shape of the shape of an abbreviation rectangle, the shape of a triangle, and a semicircle. In addition, in case cutting of spiral slot 4a processes shaft 4 peripheral face, it can be once carried out in chucking.

[0064] If the peripheral face of a shaft 4 is equipped with the outer case member 5 by this spiral slot 4a, by it, the spiral free passage hole 7 which continues between the minute gaps formed in the lower limit section 26, i.e., the thrust bearing section, and the static pressure bearing 28 will be specified between the inner skin of the outer case member 5 from the direction upper limit section of an axis of the inner skin of the outer case member 5. The internal pressure of the oil which oil is held in the free passage hole 7 at the these thrust bearing section 26 list succeeding the oil held at the static pressure bearing 28, and is held in the free passage hole 7 is a pressure almost equivalent to the internal pressure of the oil in the thrust bearing section 26.

[0065] Under the effect of the conclusion stress produced in case a male screw is concluded by female screw hole 4b (see drawing 2) prepared in that the greatest processing tolerance of the inner skin of a sleeve 8 or the peripheral face of the outer case member 5 is put together, or a shaft 4 When change arises [the minute gap formed between the inner skin of a sleeve 8, and the peripheral face of the outer case member 5] in a clearance dimension in a direction upper limit section of axis, and lower limit section side, induction of the unusual flow will be carried out to oil. Consequently, a difference will arise in the internal pressure of oil between the direction upper limit section side of an axis of the minute gap formed between the inner skin of a sleeve 8, and the peripheral face of the outer case member 5, and the lower limit section side 28, i.e., the thrust bearing section 26 and static pressure bearing. If the difference of the internal pressure of this oil is left, when negative pressure will occur in the static pressure bearing 28 when oil flows from the direction lower limit section side of an axis to an upper limit section side and oil will flow from the direction upper limit section side of an axis to a lower limit section side, the internal pressure of oil increases by the static pressure bearing 28 beyond the need, and fault surfacing of Rota 6 occurs.

[0066] By on the other hand, the thing to establish for the free passage hole 7 with which oil is held succeeding the oil held continuously at the static pressure bearing 28 at these thrust bearing section 26 list in between the minute gaps formed in the thrust bearing section 26 and the static pressure bearing 28, and to carry out Even if a difference arises in the internal pressure of oil in a direction upper limit section [of the minute gap which induction of the flow of the direction of an axis is carried out to the above-mentioned oil and formed between the inner skin of a sleeve 8, and the peripheral face of the outer case member 5] of axis, and lower limit section side Since a flow of the oil to a low side arises from a side with high internal pressure through the free passage hole 7, the internal pressure of the oil held at each bearing balances, and generating of negative pressure or fault surfacing is prevented.

[0067] (5) The modification of the herringbone grooves 22a and 24a formed in the radial bearing sections 22 and 24 in the spindle motor of the operation gestalt illustrated by modification above-mentioned drawing 2 thru/or drawing 6 is shown in drawing 7 (a) thru/or (d). In addition, drawing 7 is the sectional view of a sleeve 8.

[0068] (-- five --) - one . -- a modification -- one -- drawing 7 -- (-- a --) -- illustrating -- a modification -- **** -- the upper part -- radial bearing -- the section -- 22 -- ' -- forming -- having -- a herringbone -- a groove -- 22 -- a -- ' -- an axis -- a direction -- being unsymmetrical -- a configuration -- having -- **** -

- the lower part -- radial bearing -- the section -- 24 -- forming -- having -- a herringbone -- a groove -- 24 -- a -- drawing 2 -- and -- drawing 3 -- illustrating -- operation -- a gestalt -- a case -- the same -- an axis -- a direction -- being symmetrical -- a configuration -- having -- **** .

[0069] Herringbone groove 22a' formed in up radial bearing section 22' more specifically Spiral groove 22a'1 located in the upper part side (thrust-bearing section 26) of a sleeve 8 It is set up so that the direction dimension of an axis may become long rather than spiral groove 22a'2 located in the lower radial bearing section 24 side. For this reason, the articulated section of spiral groove 22a'1 of a pair and 22a'2 is deflected and located in a under-surface [than the core of up radial bearing section 22'] 24, i.e., the lower radial bearing section, side. For this reason, at the time of rotation of Rota 6, the pumping to the oil by spiral groove 22a'1 exceeds the pumping by spiral groove 22a'2, and carries out induction of the flow which goes to the lower part side (lower radial bearing section 24 side) of a sleeve 8 to oil as up radial bearing section 22'.

[0070] Thus, by making herringbone groove 22a[of up radial bearing section 22']' into a configuration imbalanced in the direction of an axis, the pressure of the field between up radial bearing section 22' and the lower radial bearing section 24 is maintained at the positive pressure more than atmospheric pressure, and generating of negative pressure is prevented. Moreover, oil always flows to the lower part side of a sleeve 8, the oil which flowed to the lower part side of a sleeve 8 returns from the lower part side of a sleeve 8 to an upper part side through the fr[illegible]assage way 7 by the thrust which herringbone groove 22a' generates, again, it will be pushed into the lower part side of a sleeve 8 by up radial bearing section 22', and a fixed oil circuit is formed of it.

[0071] Thus, by making oil always flow in the predetermined direction in a bearing gap, the stability of pressure balancing of the oil held to each field in a bearing gap will be aimed at by herringbone groove 22', and generating of negative pressure and generating of fault surfacing of Rota 6 will be certainly prevented. moreover, even when the stress deformation at the time of processing tolerance or assembly arises, circulation of the oil to the fixed direction is secured, and since the tolerance to the fault resulting from processing or assembly is markedly alike and is expanded, the yield is improved.

[0072] (5) -- the -2. modification 2 -- herringbone groove 24a formed not only in up radial bearing section 22' but in lower radial bearing section 24' again as illustrated to drawing 7 (b) -- ' -- The inside of spiral groove 24a'1 which constitutes this, and 24a'2, Spiral groove 24a'1 located in an up radial bearing section 22' side is set up so that the direction dimension of an axis may become long rather than spiral groove 24a'2 located in the lower part side of a sleeve 8. It is also possible to consider as a configuration unsymmetrical in the direction of an axis constituted so that the articulated section might be deflected and located in the lower part side of a sleeve 8.

[0073] Thus, the pressure of the static pressure bearing 28 in drawing 2 becomes higher, and the surfacing force of Rota 6 is strengthened with constituting so that induction of the flow to which not only up radial bearing section 22' but lower radial bearing section 24' goes to the lower part side of a sleeve 8 to oil may be carried out. Therefore, since the load of a heavy load can be supported more now, it becomes possible to use, also when carrying out the rotation drive of two or more disk plates. Moreover, it is urged to more positive circulation to oil, and generating of fault surfacing of negative pressure or Rota 6 is prevented effectively.

[0074] (5) It is illustrated by -3. modification 3 drawing 7 (c). A modification 3 Like the case of the above-mentioned modification 1 and a modification 2, herringbone groove 22a' formed in up radial bearing section 22' so that a flow by the side of the lower radial bearing section may occur to oil Although it is set up so that the direction dimension of an axis may become long rather than spiral groove 22a'2 to which spiral groove 22a'1 located in the thrust-bearing section 26 side is located in a lower radial bearing section side Herringbone groove 24a″ formed in lower radial bearing section 24″ The direction of spiral groove 24a″spiral groove 24alocated in lower part side of sleeve 8 rather than 1″2 located in an up radial bearing section 22' side is formed so that the direction dimension of an axis may become long a little.

[0075] therefore, lower radial bearing section 24″ -- up radial bearing section 22from side' -- it is urged to a flow of the oil which goes to a side, and generating of the negative pressure in the field between up radial bearing section 22' and lower radial bearing section 24″ is prevented. in addition -- the lower part -- radial bearing -- the section -- 24 -- ″ -- a herringbone -- a groove -- 24 -- a -- ″ -- it can set -- a spiral -- a groove -- 24 -- a -- ″ -- one -- 24 -- a -- ″ -- two -- variation of tolerance -- the upper part -- radial bearing -- the section -- 22 -- ' -- a herringbone -- a groove -- 22 -- ' -- a herringbone -- a groove -- 22 -- a -- ' -- it -- small -- for this reason, lower radial bearing section 24″ generated in up radial bearing section 22' -- up radial bearing section 22' which a flow of the oil which goes to a side generates in lower radial bearing section 24″ -- it is not prevented by flow of the oil which goes to a side

[0076] (5) The herringbone groove in the up radial bearing section is set to herringbone groove 22a of a configuration symmetrical with the direction of an axis like the operation gestalt illustrated to drawing 2 and

drawing 3 so that it may be illustrated by the -4. modification 4 and also drawing 7 (d). It is possible to consider as herringbone groove 24a' of the unsymmetrical configuration deflected to the lower part side of a sleeve 8 as well as the modification 2 which illustrates the herringbone groove in the lower radial bearing section to drawing 7 (b). In this case, the variation of tolerance of spiral groove 24a'1 in lower radial bearing section 24', and 24a'2 Since it is smaller than the case where the herringbone groove by the side of the up radial bearing section is made into an unsymmetrical configuration, Generating a flow of the oil which goes to the lower part side of a sleeve 8, and expanding the permissible dose to the stress deformation at the time of processing tolerance or assembly, the vertical radial bearing section 22 and the bearing span between 24' can be greatly secured in comparison, and it is possible to make bearing rigidity high.

[0077] In addition, the internal pressure of the oil held at the static pressure bearing 28 by carrying out induction of the flow which goes to the lower part side of a sleeve 8 from a radial bearing section side to oil will be balanced in total with the fluid pressure by which induction is carried out in the thrust-bearing section 26, and the fluid pressure of the oil from a radial bearing section side so that it may be illustrated by drawing 7 (a) thru/or (d). For this reason, the support by which load-carrying capacity was increase-stabilized is attained.

[0078] (6) The internal configuration of the common disk driving gear 50 is shown in the block diagram 8 of a disk driving gear as a mimetic diagram. The interior of housing 51 forms clean space with little dust, dust, etc. to the degree of pole, and the spindle motor 52 with which it was equipped with the disc-like disk plate 53 which memorizes information is installed in the interior. In addition, inside housing 51, the head migration device 57 in which information is written to the disk plate 53 is arranged, and this head migration device 57 is constituted by the actuator section 54 which moves the head 56 which write the information on the disk plate 53, the arm 55 supporting this head, a head 56, and an arm 55 to the necessary location on the disk plate 53.

[0079] By using the spindle motor illustrated in drawing 2 thru/or drawing 7 as a spindle motor 52 of such a disk driving gear 50, although a desired rotation precision is acquired, low cost-ization is attained at the thin shape-ized list of the disk driving gear 50.

[0080] As mentioned above, although 1 operation gestalt of a disk driving gear was explained to the spindle motor list according to this invention, various deformation thru/or corrections is possible for this invention, without not being limited to this operation gestalt and deviating from the range of this invention.

[0081] for example , it be also possible to change to spiral groove 26a of the pump in type explained in the above-mentioned operation gestalt as a means form in the thrust bearing section to generate the pressure which act on the method of the inside of radial to oil , and to consider as the herringbone groove which have an imbalanced configuration in radial .

[0082] When the herringbone groove of a configuration imbalanced to radial is prepared in the thrust-bearing section, a slot item called the tilt angle or the radial flute width, and the radial depth to a dimension and a hand of cut is set up so that the pumping force of generating the spiral groove located in the method side of the outside of radial among the spiral grooves of the pair which constitutes a herringbone groove rather than the spiral groove located in the method side of the inside of radial may serve as size. The amount of imbalance of the pumping force of a spiral groove in which it is located in the method side of the outside of radial [this], and the pumping force of a spiral groove in which it is located in the method side of the inside of radial serves as a pressure which acts on the method of the inside of radial [which is given to oil], and the internal pressure of the oil held at the thrust bearing section is raised like the case of a spiral groove above-mentioned pump in type.

[0083] In addition, since the surfacing force given to Rota becomes higher than the surfacing force generated in a spiral groove when the above-mentioned herringbone groove is prepared in the thrust-bearing section, while the load bearing capacity by the thrust-bearing section improves, there are surfacing force generated in static pressure bearing and concern which fault surfacing of Rota generates conjointly. Therefore, it is necessary to control this by the magnetic energization force given to Rota.

[0084] Moreover, although the so-called inner rotor type with which a stator 14 is arranged at the method side of the outside of radial of the Rota magnet 16 of spindle motor was mentioned as the example and explanation of the above-mentioned operation gestalt explained it, it has the natural Rota magnet 16 that this invention is applicable also to the so-called outer rotor type arranged at the method side of the outside of radial of a stator 14 of spindle motor.

[0085]

[Effect of the Invention] In the spindle motor of claim 1 of this invention, negative pressure and the problem of fault surfacing are solved in the hydrodynamic bearing of full philharmonic structure, and the axial support stabilized with the simple configuration is attained.

[0086] In the spindle motor of claim 2 of this invention, it becomes possible to form easily the free passage hole for preventing generating of negative pressure or fault surfacing.

[0087] In the spindle motor of this invention according to claim 3, the bearing span between the radial bearing sections of a pair can be greatly secured in comparison, and it becomes possible to maintain bearing rigidity highly.
[0088] In the spindle motor of this invention according to claim 4, while the permissible dose to the stress deformation at the time of processing tolerance or assembly is expanded by urging compulsory circulation to the oil in bearing and the yield is improved, it becomes possible to stabilize the behavior of oil more.
[0089] In the spindle motor of this invention according to claim 5, while becoming possible to support a higher load, it becomes possible to prevent generating of fault surfacing of negative pressure or Rota effectively.
[0090] In the spindle motor of this invention according to claim 6, it becomes possible to prevent generating of the negative pressure in the field between the radial bearing sections of a pair, urging compulsory circulation to oil and stabilizing the improvement of the yield, and the behavior of oil.
[0091] In the spindle motor of this invention according to claim 7, expanding the permissible dose to the stress deformation at the time of processing tolerance or assembly, the bearing span between the radial bearing sections of a pair can be greatly secured in comparison, and it becomes possible to make bearing rigidity high.
[0092] In the spindle motor of claim 8 of this invention, even if it is a thin motor, it becomes possible to maintain sufficient seal function.
[0093] In the spindle motor of claim 9 of this invention, it enables thin shape-ization of a motor to prevent more effectively [the outflow of the oil to the bearing exterior by the oil mist] with promotion **** further.
[0094] In the spindle motor of claim 10 of this invention, it becomes possible to be stabilized and to perform axial support of the direction of an axis, without increasing loss by bearing.
[0095] In the disk driving gear of claim 11 of this invention, although a desired rotation precision is acquired, low cost-ization is attained at small and the thin shape-ized list of a disk driving gear.

[Translation done.]

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2.**** shows the word which can not be translated.
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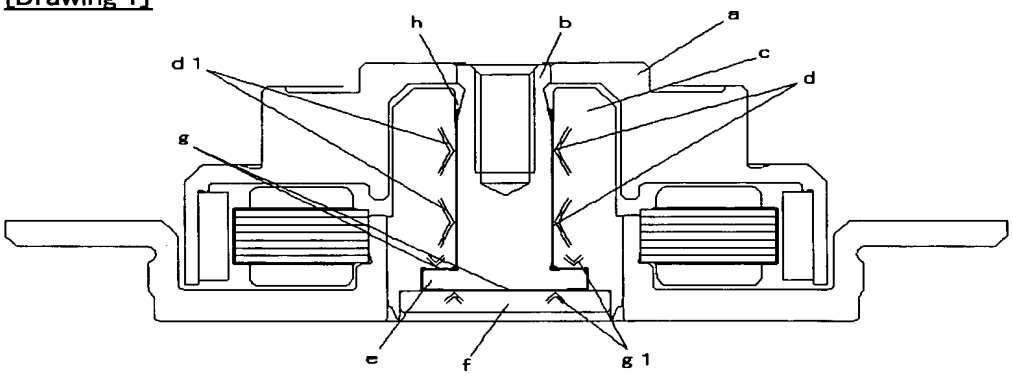
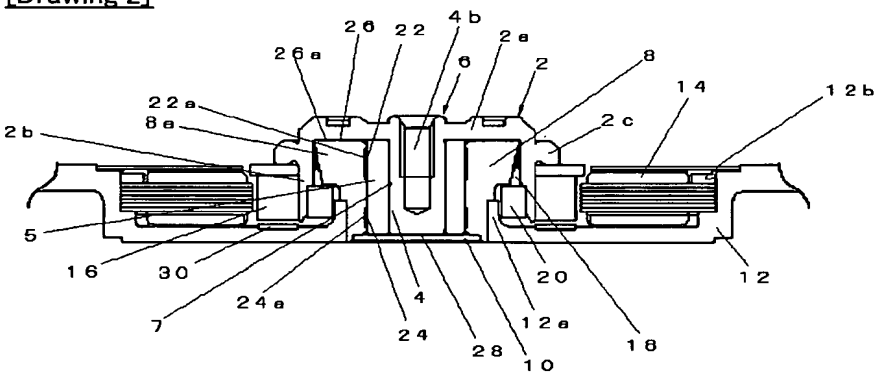
DRAWINGS

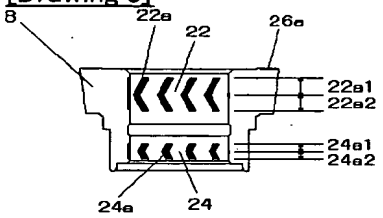
[Drawing 1]



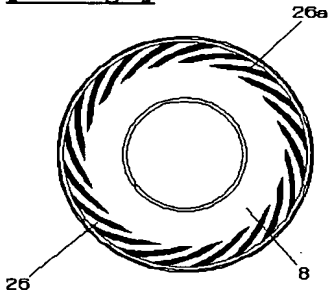
[Drawing 2]



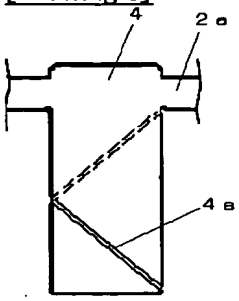
[Drawing 3]



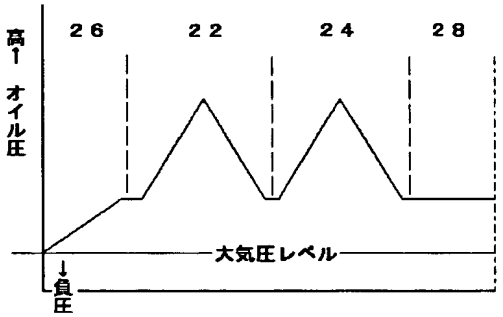
[Drawing 4]



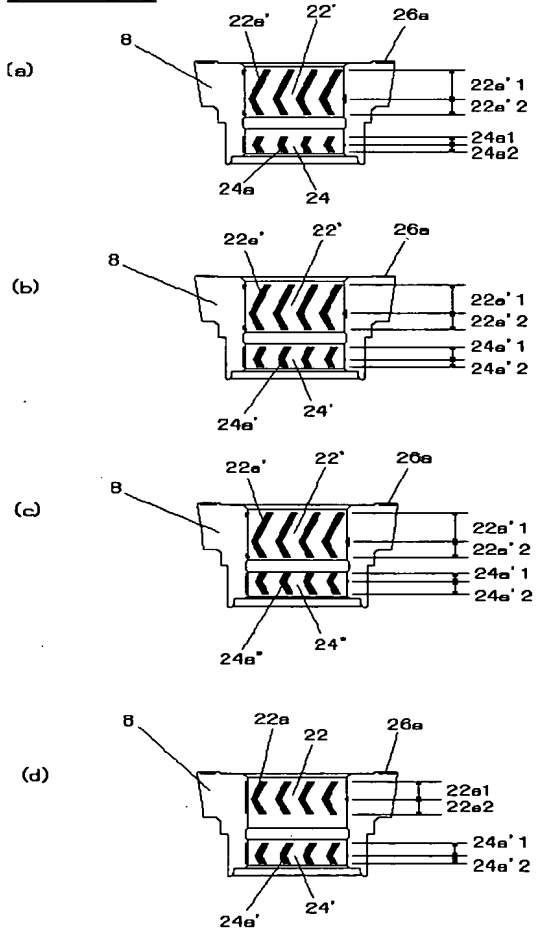
[Drawing 6]



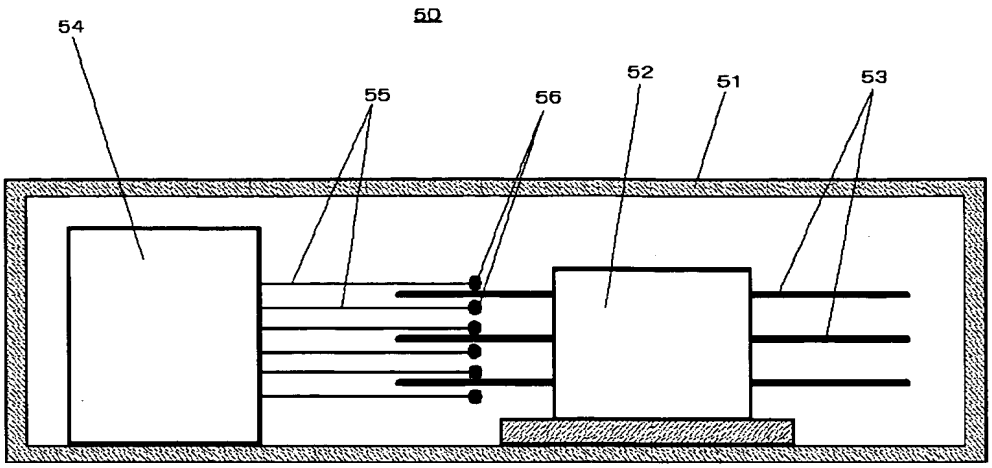
[Drawing 5]
圧力分布図



[Drawing 7]



[Drawing 8]



[Translation done.]